The menisci are semi lunar shaped regions of cartilage on the medial and lateral sides of the knee joint. The medial meniscus is semicircular in shape and the lateral meniscus is almost a complete circle.\textsuperscript{7} The medial meniscus is less mobile than the lateral translating 2 to 5 mm. The lateral translates 9 to 11 mm in the anterio-posterior plane.\textsuperscript{7} The medial meniscus translates less secondary to its attachments to the medial collateral ligament. Therefore, there is an increased incidence of medial meniscal tearing.\textsuperscript{7} The lateral meniscus is less firmly attached around its peripheral region. The anterior horn moves less than the posterior horn. Over 70\% of tears occur in the posterior horns. The meniscus is 75\% type one collagen.\textsuperscript{7} The fibers run along longitudinal (circumferential) and radial patterns. The longitudinal fibers allow for axial loading while radial fibers allow for rotational loading. The peripheral 20\%-30\% of the medial meniscus and 10\%-25\% of the lateral meniscus are vascular.\textsuperscript{7} Healing is greatly enhanced in these vascular regions. During flexion the femoral condyles compress on the posterior horns causing anterio-posterior spread. During knee extension the condylies compress on the anterior horns causing mediolateral deformation.\textsuperscript{9} Meniscal motion undergoes both anterio-posterior translation as well as rotatory motion along the tibial plateau. Meniscal motion is determined directly by osseous configuration of the tibiofemoral joint, but the motion is indirectly influenced by contraction of the quadriceps, semimembranosus and popliteus muscles. Meniscal motion follows the direction of femoral condyle displacement. Should the menisci fail to follow the femoral condyles along the tibial plateau they risk entrapment between the two articulating surfaces and sustaining injury due to compression.\textsuperscript{9} During terminal knee extension the tibia and femur move in opposite directions, therefore it is during the last 20-30 degrees of extension that the menisci are at greatest risk.\textsuperscript{9}

One function of the meniscus is to distribute loads across the knee joint. The menisci transmit approximately 50\% of the load in weight bearing (extension) and 90\% of the load at 90 degrees of knee flexion. The majority of the load is transmitted through the posterior horns with flexion past 90 degrees.\textsuperscript{9} When meniscal integrity is compromised, abnormal articular contact stress results, leading to early degenerative changes. The meniscus also plays a role in knee stability. Menisci deepen the socket of the tibia to increase contact with the femoral condyles. The meniscus can also help to limit femoral translation on the tibia. The meniscus (especially the posterior horn of the medial meniscus) can be a secondary stabilizer in an ACL deficient knee.\textsuperscript{7} Finally, the meniscus has a role in joint lubrication. When the knee is loaded, the meniscus is compressed, synovial fluid is driven into the articular cartilage, thereby decreasing friction and providing joint nutrition.\textsuperscript{9}
The most frequent mechanism of injury is non-contact stress from deceleration or acceleration coupled with a change in direction- cutting maneuver. Contact stress may also cause a meniscal tear, from a varus, valgus or hyperextension force coupled with a rotational motion. This mechanism can also result in a concurrent collateral ligamentous sprain.  

Classification of meniscal tears include; complete or partial, horizontal or vertical, longitudinal or transverse. Horizontal tears are most often chronic from degenerative changes. These tears usually do not cause locking but they can progress to flap tears causing popping or clicking. Vertical tears/longitudinal tears are most often traumatic. These tears are also known as “bucket handle” tears. When an unstable fragment from a bucket-handle tear moves into the intracondlar notch it blocks full extension of the knee joint. Tears in the central aspect of the meniscus characterize radial tears. These tears may migrate towards the periphery and turn into a “parrot beak” tear. Signs may include: swelling, give-way or catching.  

Healing is influenced by the pattern of the tear and the type of vascularity. Longitudinal tears heal better than radial tears. Simple tears heal better than complex tears. Traumatic tears have higher healing rates than degenerative tears, and acute tears heal better than chronic tears.

Conservative vs. surgical management is determined by seeking an intervention, which maintains the best long-term results with the lowest possible risk for degenerative arthritis.

- **Conservative management of meniscal tears:** Most often these tears are longitudinal partial thickness tears along the posterior horn of the lateral meniscus associated with an ACL tear. Full thickness peripheral tears less than 5mm and radial tears less than 5mm may also be conservatively managed.

- **Meniscal repair:** Typically in indicated for lesions within 3mm of the vascular zone; normal contour and greater than 7mm. Repair is also more successful with an intact or reconstructed ACL, vs. an ACL deficient knee.

- **Partial menisectomy** is the operative resection of the mobile portion of irreparable types of lesions.

Possible ICD 9 Codes:

<table>
<thead>
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<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>717.3</td>
<td>derangement of the medial meniscus</td>
</tr>
<tr>
<td>717.4</td>
<td>derangement of the lateral meniscus</td>
</tr>
<tr>
<td>836.0</td>
<td>lateral meniscus tear</td>
</tr>
<tr>
<td>836.1</td>
<td>medial meniscus tear</td>
</tr>
</tbody>
</table>

**Indications for Treatment:**

1) Pain  
2) Swelling/edema

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**Standard of Care: Meniscal Tears**  
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3) Instability
4) Impaired function
5) Gait impairment
6) Loss of ROM

Contraindications / Precautions for Treatment:
- Acute patients should avoid further athletic participation and excessive loading to meniscus.
- Please see protocols for post operative care of meniscal repair, menisectomy and repair with ACL reconstruction.

Examination:

Medical History: Complete review of medical history questionnaire (ambulatory evaluation), medical record (day surgery unit) and medical history in hospitalized computer system record/LMR. Review of diagnostic imaging in LMR or centricity and/or operative notes listed in LMR should also be examined. MRI is 90% accurate in terms of diagnosis of meniscal tears, however arthroscopy is the gold standard for diagnosis.  

History of Present Illness: Questions regarding 1) The mechanism of injury- traumatic or degenerative 2) presence of locking, giving way or catching (displaced fragments can act as mechanical block) 3) Presence of pain- the peripheral 1/3 only- degenerative tears to the middle 2/3 are less likely to be painful since they are devoid of free nerve endings 4) swelling –if a tear is in the red zone swelling usually develops in 1-3 days. Swelling 1-2 hours after trauma usually indicates a concurrent ligamentous injury or fracture. 

Social History: The patients home, work, recreational and social activities should be investigated.

Medications: Patients may be taking non-steroidal anti-inflammatory medications, and may have had a corticosteroid injection.

Examination (Physical / Cognitive / applicable tests and measures / other)
This section is intended to capture the minimum data set and identify specific circumstance(s) that might require additional tests and measures.

Pain: As measured on the Visual Analog Scale/Verbal Rating Scale/Numerical Rating Scale, activities that increase symptoms decrease symptoms, location of symptoms and irritability level. Use body diagram to indicate all areas where symptoms are reported and which are most frequently present.

Inspection: Decreased thigh girth and atrophy of quad-can be a sign of chronic tear secondary to reflex inhibition. Dimple effect of the VMO may occur in patients who cannot achieve full extension.

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Posture: Varus knee malalignment tends to overload the medial knee compartment. Valgus malalignment overloads the lateral meniscus. Patients with poor alignment tend to have more degenerative tears, which have a poorer healing capacity. Patient’s foot alignment should also be assessed.

Palpation: (for edema, pain and joint line tenderness) Edema may be activity dependent. Edema may or may not be present depending upon the site of the tear (vascular or avascular region). Girth measurements may be taken to track edema or atrophy. Joint line tenderness is the most reliable clinical sign in a patient with an intact ACL. (Tenderness can be non-specific if ACL, MCL or OA is suspected) Tenderness has been shown to be 96% accurate, 89% sensitive and 97% specific for the lateral meniscus and 74% accurate, 86% sensitive and 67% specific for the medial meniscus. The peripheral portions of the meniscal bodies contain free nerve endings, the central one third of the menisci are devoid of innervation.

Range of motion: (check for lack of extension or full flexion) Displaced flap may limit motion. Knee, hip and ankle ROM should be noted.

Special tests for meniscal integrity: 1) McMurrays - Loading of the lateral and medial meniscus, from a fully flexed position with ER or IR. Clicking is suggestive of a meniscal tear. Pain during knee flexion implicates the posterior horns. Pain with extension implicates the anterior horns. Internal rotation tests the lateral meniscus while external rotation tests the medial meniscus. Positive predictive values have a wide range from 29% to 92% among studies. 2) Apley’s compression tests- comprises of rotation plus compression, then rotation plus distraction with the patient prone and the knee flexed at 90. If pain is present with distraction- the lesion is more likely ligamentous. If the pain is with compression the lesion is more likely meniscus.

Special tests for ligamentous integrity: To rule out or in associated knee pathology. Full descriptions for knee special tests can be found in Magee.

It should be noted that when clusters of tests are used diagnostic accuracy improves.

These and other special tests for the knee can be found in:


Functional assessment:
1) The Lower Extremity Functional Scale
2) LIFEware- modified Lysolm Knee Index

May be used to assess patient’s ongoing functional status

Screening: The spine, hip and ankle should be routinely screened in all patients with knee pain to rule out other potential impairments that may be contributing to lower extremity pain and diminished function.
Differential Diagnosis (if applicable):  
1. Discoid meniscus- congenital abnormality of the lateral meniscus lacking a crescent shape.
2. Cystic menisci- infiltration of synovial fluid through a horizontal tear. (Typically lateral)
3. Popliteus tendonitis – muscle may be come enlarged secondary to its rolling “unlocking the screw-home mechanism” and become entrapped.
4. Plicae-repeated rubbing of the mediopatellar plica across the medial femoral condyle and the medial patellar facet may contribute to chondromalacia.
5. Osteocondritis dissecans-Osseous lesion to the medial femoral condyle, lateral femoral condyle and the patella. Fragment “joint mice” may cause mechanical symptoms.
6. Meniscotibial ligament sprain- in conjunction with a medial collateral ligament sprain. This may be clinically indistinguishable from a meniscal tear. Only diagnosed via arthroscopy.
7. Tibial spine avulsion fracture- the medial meniscus may be entrapped beneath the fracture segment.
8. Fat pad syndrome- if the fat pad is converted to fibrocartilage secondary to repetitive trauma, or repetitive surgical intervention, the pad may be entrapped between the patella and the femur. Resulting in similar symptoms to meniscal tear.

Evaluation / Assessment:

Establish Diagnosis and Need for Skilled Services

Potential Problem List:
1) Pain
2) Edema
3) Decreased ROM
4) Impaired Strength
5) Impaired functional mobility
6) Impaired Gait
7) Knowledge deficit regarding activity modification and progression of activity

Prognosis: Approximately one-third of tears can be treated conservatively with full resolution of symptoms. Two thirds will require surgical intervention. Some studies suggest patients who are compliant with home exercise program s/p partial menisectomy do not require formal PT intervention.

Goals: (with measurable parameters and with specific timelines)
1) Pain free gait, functional mobility and ADL’s in 8-12 wks as reported on VAS and/or functional outcome measures
2) Non-palpable edema in 4wks
3) Full Rom involved equals non-involved in 4-6wks
4) At least 4/5 MMT all Le planes in 6-8wks
5) Non-antalgic, normalized gait with/without assistive device in 6wks

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6) Independent with home therapy program both initial and progressed in 8-12 wks.

**Age Specific Considerations:** Younger patients more frequently experience longitudinal tears and peripheral detachments, most often involving the posterior horn. Teenagers typically sustain bucket handle tears. Most tears are a result of high-energy sports activities. Many clinical finding present in adults may not be found in children secondary to higher ligamentous laxity, i.e., false-positive McMurray’s testing. Children usually present with pain, antalgia, locking, as well as swelling and joint line tenderness. Older patients should undergo conservative management secondary to the likelihood of degenerative tears, unless a mechanical block is found.

**Treatment Planning / Interventions**

<table>
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<tr>
<th>Established Pathway</th>
<th>___ Yes, see attached.</th>
<th>__<em>X</em> No</th>
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<tbody>
<tr>
<td>Established Protocol</td>
<td>___ yes, see attached.</td>
<td>__<em>X</em> No</td>
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</tbody>
</table>

Interventions most commonly used for this case type/diagnosis.
This section is intended to capture the most commonly used interventions for this case type/diagnosis. It is not intended to be either inclusive or exclusive of appropriate interventions.

**Acute:** (if applicable):
- Diminish inflammation and swelling - modalities as needed - see protocols
- Restore ROM - emphasizing full knee extension (flexion to tolerance)
- Facilitate quadriceps activity - E-stimulation and therapeutic exercise
- Normalize gait pattern - assistive devices and braces as needed.
- Endurance activity - decreased impact/load - bike, swimming, (no frog kick) elliptical

**Sub-Acute/Chronic:** (if applicable):
- Continue with inflammation and ROM management
- Progression to closed kinetic chain therapeutic exercise, progressive resistive therapeutic exercise. Focus on hamstring and quadriceps strengthening secondary to their dynamic role in meniscal movement.
- Balance and proprioception drills

**Goals:**
- Normal gait
- 85% strength of the contralateral side
- Progression to sport specific drills.
- Unloading braces might be helpful with degenerative tears to restore full functional mobility in a patient with a varus or valgus alignment.
Frequency/duration: Outpatient care 1-2x/wk- 2-3months as indicated by patients status and progression.

Patient / family education: Education includes home program, footwear modification, use of assistive device, pain and edema management techniques, activity modification and progression.

Recommendations and referrals to other providers: Orthopedic referral- especially if mechanical symptoms are present, ligamentous instability, osseous injury or continued symptoms after 3months.

Re-evaluation / assessment: Standard Time Frame: Every 30 days of sooner if status change occurs

Other Possible Triggers: Change in signs or symptoms, or new trauma

Discharge Planning:

Commonly expected outcomes at discharge:
1) Non-antalgic gait
2) Pain free /full ROM
3) LE strength at least 4/5
4) Independent with home program
5) Normal age appropriate balance and proprioception
6) Resolved palpable edema

Patient’s discharge instructions: Continue with maintenance home program 3x/wk if symptoms have resolved. Follow up with MD as needed if symptoms return.

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Bibliography / Reference List


